Identification of Significant Ecological Sites

Approach and Methods Used to Identify Significant Ecological Sites

Building on the information compiled for the above Ecological Overview, the following steps were taken between June 2001 and June 2002 to determine the most significant ecological features of the FRHE study area and to provide some considerations for conservation attention.

1. A limited field inventory of areas with high potential for rare plants and natural communities was conducted during the summer of 2001. BER staff used NHI county inventory files from the late 1970s, information from the 1996 White River Feasibility Study, and suggestions from local experts to develop a list of 27 potential inventory sites. Rapid field surveys were conducted for 22 of these sites to assess their overall condition and ecological quality, and to determine future inventory needs. New data from the inventory effort were compiled, and existing records in the NHI database were updated. A copy of the inventory report is available from the Bureau of Endangered Resources.
2. A coarse filter inventory, using GIS database queries, aerial photographs, and limited ground surveys, identified 48 locations with potential to provide quality habitat or restoration opportunities (see Appendix B).
3. Knowledgeable local individuals were solicited for information about the FRHE area resulting in the identification of 192 records of natural communities, critical habitats, populations of rare plants and animals, and other unique features (see Appendices D and E).
4. The 48 coarse filter locations and the 192 records from individual contributors were combined into 83 sites based on the similarity of their ecological characteristics and proximity to each other.
5. People who contributed information about the FRHE area were invited to attend a workshop where small groups discussed and scored the Sites, using pre-determined ecological criteria. Sites were ranked of high, medium, or low priority for conservation based on the knowledge of the participants in each group. The scores were then averaged to provide an indication of conservation priority (see Appendix D).
6. BER identified 86 Significant Ecological Sites grouped into 4 categories of ecological significance (Figure 7 and Table 3). This was accomplished using the workshop results, updated NHI data, and aerial photographs of the sites and surrounding landscapes. In some cases, the placement of Significant Ecological Sites did not directly correspond to the scores generated from the Workshop.

The Final List of Significant Ecological Sites

The 86 Sites that resulted from the above process are presented in Table 3 and arranged according to their ecological significance based on currently available inventory and ecological information. The Sites are organized by the four categories below. In addition, an acreage estimate, the approximate acreage of each site in public ownership, and a site summary is provided. The site summary was extracted directly from each Workshop Contributor's site information and has not been revised or confirmed. See Figure 7 for the general location of the Sites within the FRHE. A list of documented NHI elements by site, where applicable, is provided in Appendix F.

- **High Sites** are of statewide significance and contain excellent examples of natural communities and/or rare plants or animals, which are believed to be among the best remaining examples in the study area. Such Sites are large enough to support the resources of significance without major restoration efforts and are buffered by compatible land uses in the surrounding landscape.

- **Medium-High Sites** contain some plant or animal feature of statewide significance but are somewhat compromised by surrounding land uses or past use. In some cases, Medium-High Sites contain small areas of "High" value located within a larger area of clearly "Medium" value.

- **Medium Sites** are of more regional than statewide importance and contain good or excellent examples of communities or rare plants or animals but are somewhat compromised by human disturbance, incompatible surrounding land uses, or small size. In many cases, a lack of adequate information prevented the Site from being given a higher significance.

- **Low Sites** are generally of local significance and may contain good or excellent examples of communities or rare plants or animals but are substantially compromised by human disturbance, small size, surrounding land uses, invasive species, or other significant ecological constraints. In some cases, inventory is lacking such that a higher significance could not be assigned without additional information. Future inventory could clarify the ecological significance of a Site.

Eighteen of the Significant Ecological Sites are ranked High, 9 are Medium-High, 32 are Medium, and 27 are Low. The placement of the Sites within these categories is somewhat arbitrary – although there is a wide variation of significance between "high" and "low" Sites, all of the Sites contain features considered ecologically significant. Sites are not further prioritized within each category, so the relative significance of Sites within each group is the same. Opportunities for conservation are discussed in the next section.

Some generalizations can be made about the categories to provide a broad overview of the conservation potential within the FHRE area. "High" Sites tend to represent large, unfragmented areas with a varied complex of high quality natural communities and/or rare species populations. "Medium-High" Sites are similar to the above, but tend to be somewhat smaller in size and may include fewer occurrences of rare species. Many Sites in both categories have a portion of their area under some kind of public protection.

The 32 "Medium" Sites, the largest number in any of the four categories, tend to be smaller in size than the higher priority Sites and have lower concentrations of rare species. The 27 "Low" Sites are typically very small size, and many are without documented element occurrences. Many of the Sites in both categories are currently in private ownership. It should be noted that placement in the "Medium" or "Low" categories does not mean that sites are of low value. Again, all of the sites were identified through this analysis because they contained some natural resource(s) of ecological significance. As such, they contain ecological values that may warrant conservation at some level. In addition, there may be other sites not included within these sites that are important in their own right but adequate information does not currently exist.

Table 3. Significant Ecological Sites

Site Name	Size[1] (acres)	% public ownership[2]	Abbreviated summary of Contributor's Site records
Sites of High Ecological Significance			
Caves / Tagatz Fisheries	18,854	13	High quality cold water stream with varied uplands, including oak savanna, dry prairie, jack pine barrens, and numerous springs and spring seepages.
French Creek Wetland	3,529	70	Large, open wetland with sedge meadow and emergent aquatics. Important for numerous rare fish species. Conservation priority reflects the need to revise the boundary to include French Creek up to the dam.
FRNW Refuge / Packwaukee	2,298	33	Fox River National Wildlife Refuge with river, wetland, grassland, woods, and nearby spring-fed kettle lake.
Germania Wildlife Area	17,666	3	Extensive tamarack fen and sedge meadow. Cold water streams grading to warm water stream systems. Intact wetland complex. Many impoundments.
Grand River Wildlife Area	23,857	32	Extensive lake, wetland, and wet prairie complexes.
Lawrence Creek	6,964	14	Large cold water complex of springs, spring-fed tributaries, ephemeral ponds, wetlands, seepage lakes, and Lawrence Creek. Site may also have good upland restoration potential.
Mecan River Fisheries Area	29,204	26	High quality cold water stream with varied uplands, including sand prairie, savanna, and oak barrens.
Mecan Springs	3,559	--	Springs and streams. Includes lakes with undeveloped shorelines.
Mitchell's Glen	611	--	Spring forested limestone gorge with springs, maple-basswood forest, and oak savanna.
Mud Lake	2,358	--	Originally included in the "Fluctuating Shoreline Lakes" workshop site that was subsequently divided. Undeveloped area under single ownership. Site includes the southern extension of northern bog communities.
Neenah Creek Valley	7,159	--	Large complex of springs with associated wetlands, fens, and sedge meadows.
Oxbo Wetlands	337	--	Lowland hardwoods, marsh, and river bayous. Current or historic walleye and lake sturgeon spawning habitat. Has globally rare fish and is relatively intact.
Puckaway Critical Habitat	147		Originally the Puckaway Lake Work shop site. The site does not include the entire lake.
Puckaway Flatwoods	8,061	--	Disturbed but relatively large, intact complex of dry to wet oak, pine, and red maple forest.
Silver and Mud Lakes	813	--	Silver Lake is a shallow groundwater lake that contains documented occurrences of several rare species. Mud Lake is a big lake surrounded by tamarack forest.
Steuck's Pond	850		Originally included in the "Fluctuating Shoreline Lakes" workshop site that was subsequently divided. Undeveloped area under single ownership.
White River Fisheries	12,755	22	Large complex of springs and cold water streams, with adjacent high quality prairie.
White River Marsh Area	95,565	18	Very extensive complex of high quality wetland communities, including sedge meadows and wet prairies. Also includes a stretch of significant warm water stream with intact aquatic fauna and rare species.
Sites of Medium-High Ecological Significance			
Bass Lake	5,283	2	Undeveloped complex of wetlands, flowages and an undeveloped deep water lake. Contains several rare species.

Site Name	Size[1] (acres)	% public ownership[2]	Abbreviated summary of Contributor's Site records
Berlin Fen & Sedge Meadow	721	3	Good quality fen community with numerous rare species. Site compromised by surrounding land uses and unknown hydrologic impacts. Long-term viability is in question.
Corning - Weeting Lakes	2,700	--	Large forested wetland including tamarack swamp, sedge meadow and bog. Contains black spruce at the southernmost edge of its range.
Fluctuating Shoreline Lakes		--	Originally part of the larger "Fluctuating Shoreline Lakes" workshop site that was, subsequently, divided. Undeveloped area under single ownership. Inventory needed.
Klawitter Creek Fen	58	--	High quality, 5-acre prairie fen or calcareous fen consisting of two patches separated by a woody thicket, along the north side of Klawitter Creek, a cold, hard, fast trout stream.
Montello River	2,921	--	High quality warm water river with extensive silver maple floodplain forest (second growth). Lake (Harris Pond) with undeveloped shoreline and wild rice on one side. Locally rare floodplain forest and populations of rare plant species.
Page Creek	1,283	23	(Originally the "Buffalo Lake Area" Workshop site). Contains quality but fragmented occurrences of oak barrens, prairie, savanna, kettle lake, clear water stream, sedge meadow, and shrub-carr. Contains several rare species but is compromised by surrounding agriculture.
Sugar Island Wetlands	89	--	Peninsula and wetlands adjacent to Mitchell's Glenn, includes sugar maple and emergent marsh.
Summerton Bog North/South	1,484	29	Complex of good quality wetland communities including bog, fen, tamarack, and sedge meadow. The northern portion of this site contains several rare elements.
Swamp Lake	623	--	Originally part of the larger "Bog Relicts" workshop site that was, subsequently, divided. Large wetland forest complex including a good quality seepage lake with tamarack on Swamp Lake
Sites of Medium Ecological Significance			
Adams Cty. Waterfowl PA	1,601	2	Kettle lakes and oak barren complex near the Upper Neenah Creek SNA
Becker Waterfowl PA	394	--	Complex of glacial ponds, hilltop savanna, and alder/tamarack wetland.
Bennett Oak Savanna	436	--	Remnant oak savanna currently being restored
East Jordan Woods	86	--	(Originally "Jordan Lake Area" workshop site). Mixed oak and pine woods in undeveloped and older developed areas. Boundary should be modified to include the woods east of the lake.
Greenwood Wildlife Area	10,490	7	Greenwood Wildlife Area and large area of adjacent habitat also suitable for prairie restoration. Site also includes spring-fed and seepage lakes and spring-fed tributaries to the Mecan River.
Grotzke Rd. Area	5,678	--	Complex of dry prairie, oak barrens, northern and southern dry mesic forest and sandstone outcrops.
Harris Marsh	1,290	--	Originally part of the larger "Bog Relicts" workshop site that was, subsequently, divided.
Head of Green Lake	528	--	Marsh and sedge meadows. Good size wetland, more information on status and hydrology needed.
Jackson Kettle Complex	944	--	Degraded oak barren complex with kettles comprises one of the largest forest patches in the area. This site has possible restoration potential and more information is needed about this site.
Jordan's Lake Wetland	809	--	Extensive tamarack forest surrounding lake. Lake edge also includes cattail marsh and shrub/sedge meadow complexes.
Lake Maria	710	--	Open lake contains one rare bird species. Hydrology should be investigated further for possible

Site Name	Size[1] (acres)	% public ownership[2]	Abbreviated summary of Contributor's Site records
			opportunities to restore lake levels. There may be opportunities to control the shoreline and improve habitat.
Lewiston Flatwoods	762	--	Intact sedge meadow with apparent invasion of reed canary grass. Adjacent forest block dominated by mature oak in upland and mixed pine/hardwood in lower areas. Large size and the presence of rare elements led to a medium score.
Lime Kiln Bluff	1,243	--	Dry oak forest on sandy soils and limestone outcrops. Site has restoration potential.
Lower Silver Creek	231	--	Wetland and riparian areas that are likely to harbor uncommon or rare species. More information is needed to accurately rank this site.
Lower White River	1,232	--	Six miles of undisturbed cold water stream.
Lucerne Lake	313	--	Large, contiguous, relatively undeveloped property with a high quality lake with undeveloped shoreline. Fishery apparently good, but more information and inventory are needed for this site.
Marquette Marsh	250	--	Open wetland/hardwood complex, with southern hardwood swamp, sedge meadow, and cattail marsh
Meilke Lake	932	--	Small lake with undeveloped shoreline, waterfowl habitat, remnants suitable for restoration of oak savanna and prairie. Adjacent to incompatible land uses (townhall, road) and set within agricultural matrix. May need to revise boundaries to incorporate buffer and uplands.
Moon-Echo Lakes Area	700		Originally included in the "Fluctuating Shoreline Lakes" workshop site that was, subsequently, divided. Undeveloped area under single ownership. Site represents the southern extension of northern bog communities.
New Haven Woods	2,692	--	Extensive forested (black oak) kettle complex. Unlikely to be high quality, but size and variety of site are significant.
Norwegian Bay Wetlands	245		Sedge meadow, wet prairie, and fen adjoining Green Lake. Although locally important, and a remnant of something more extensive, areas around this site are highly developed and have a number of exotic species. This would probably be a good local project.
Oxford Woods and Savanna	9,947	--	Greenwood Wildlife Area and large area of adjacent habitat also suitable for prairie restoration. Site also includes spring-fed and seepage lakes and spring-fed tributaries to the Mecan River. This site is a large, intact upland site in need of inventory and an excellent restoration opportunity.
Packwaukee Hdwd. Swamp	893	--	Wet forest with tamarack and hardwoods with fen qualities.
Princeton Sturgeon Site	7	--	Current or historic lake sturgeon spawning site; natural riffles and rip-rapped shoreline
Rock Hill Outcrops	472		Complex of rhyolite outcrops with intact cedar glade. Based on aerial photos, the site is fragmented and has no evidence of rare species. Site has a documented past history of grazing.
Soules Creek Area	5,634	9	Wetland headwaters, leading in to high quality cold water streams. More information is needed for this site, as it may harbor rare species
Stone Hill Swamp	725		Originally part of the larger "Bog Relicts" workshop site that was, subsequently, divided. Large tamarack swamp.
Sucker Creek	1,014	--	Class I cold water stream, with wetland headwaters. There is little information on this site, and no known importance from a rare plant or natural community standpoint.
Swan Lake Wildlife Area	3,431	80	Large mostly state-owned marsh including sedge meadow with rare plants and prairie remnants.

Site Name	Size[1] (acres)	% public ownership[2]	Abbreviated summary of Contributor's Site records
Thompson Lakes Area	2,349	8	SNA with rare acid bedrock glade. Adjacent lands with similar attributes - also seepage lakes with surrounding savanna.
Utley Prairie	97	--	Upland prairie on rhyolite-gneiss outcrop
White River - West Branch	1,483	47	Large open-forested wetland complex adjoining the Mecan and White Rivers. Includes extensive agriculture, but could be good upland restoration project connecting adjacent streams.
Sites of Low Ecological Significance			
Bannerman Trail	18	--	Dry prairie.
Beechnut Road Barrens	48	--	Pine barren with pasque flower and prairie smoke.
Blue Lake Marsh	123	--	Marsh located on Blue Lake and the beginning of the Widow Green Creek.
Briggsville Conifer Swamp	273	--	Large, intact conifer swamp with tamarack and black spruce.
Byers Wetland	86	--	Agricultural land restored to grassland and wetland.
Cuff Lake	34	--	Undeveloped seepage lake.
Dreheim / Berndt Restoration	374	--	Two farms with prairie restorations, wet meadows, and ponds.
Fox River Headwaters	247	--	Sedge meadow and cattail wetland bordering the upper Fox River.
Freedom Grasslands	79	--	Grasslands with native grasses.
Grand Lake Wetland	383	--	Extensive open wetland and mesic forest complex adjacent to Grand Lake.
Green Lake Center	203	--	Wooded area on old nursery site that includes American chestnut.
Grn Lk Station Sedge Meadow	35	--	Very small sedge meadow.
Hwy 82 Grasslands	157	--	Grassland with restoration potential for native grasses and grassland birds.
Kolka Property	170	--	Karner Blue butterfly habitat, being protected and restored by owners.
Koro Bog	266		Open bog/hardwood complex in depression adjacent to the watershed boundary to Rush Lake
Little Green Lake Mesic Forest	92	--	Small, but high quality, southern mesic forest with exemplary spring ponds.
Lunch Creek	1,553	--	Degraded cold water stream south of the Lunch Creek wetland. This site may represent a good restoration opportunity.
Manchester Woods	160	--	Small mixed mesic woodlot with mature hardwoods.
McCourtney	80	--	5 acre oak savanna remnant and 35 acre prairie restoration
Mitchell Grassland	86	--	Grassland with native grasses and birds.
Mt. Morris Cemetary	30	--	Site is a small remnant with Karner Blue butterfly habitat and possible prairie with prickly pear cactus.
Oxford Correctional Area	341		Grassland and oak savanna. Adjacent to USFWS property.
Patrick Lake	39	--	County park with shoreline restoration on one end with native plants and potential oak savanna restoration.
Roy Creek Forest	154	--	Mixed hardwood (southern mesic) forest, mostly second growth. Possible remnant mesic prairie. Locally important, but small, fragmented and set within an agricultural landscape.
Soo Line Prairie Remnant	1,063	1	Area contains scattered prairie remnants but is narrow and discontinuous.

Site Name	Size[1] (acres)	% public ownership[2]	Abbreviated summary of Contributor's Site records
SR 73 Degraded Wetland	8	--	Drained wetland with easy restoration potential.
Upper Neenah Creek	4,595	18	Cold water stream corridor with variety of riparian habitat including wetlands, oak savanna, pine barren, prairie potholes and bordering Goose Lake.

1. Acreages are approximations based on Site boundaries submitted by workshop contributors.

2. These figures are an approximation based on acreages in (2) and lands in public ownership at the time of this writing.

Site Analysis Considerations

The final list of the most significant Sites within the FRHE study is not meant to exclude other sites from being protected or restored, but to highlight the Sites that appear to provide the best opportunities based on the information available. As new information becomes available over time, conservation opportunities may change. The amount of detail provided by individual contributors from the FRHE Workshop was highly variable. Although there have been scientific inventories for some of the area, ***the coverage among the Sites is not consistent, and some of the existing records are now outdated***. Further inventory is recommended for many Sites with varying scopes and levels of effort.

The boundaries of each Site should be considered drafts and are in need of review. The expertise and accuracy applied to boundary delineation was different for each contributor. Sites were not subsequently reviewed in detail sufficient to delineate an appropriate boundary that reflects the resources of significance. Thus, boundaries may expand or decrease depending upon further analysis.

Finally, many of the Sites are a compilation of smaller Sites of varying degrees of significance. For instance, a Site of medium significance may contain a diverse assemblage of areas of high significance that would not be accurately reflected by the placement of the larger Site in the Medium category (e.g., White River Marsh). Further review of each Site, and in many cases additional inventory, is required to adequately define Site boundaries and designate significance.

Sites Lacking Adequate Information

Insufficient information is available for the Sites listed below, making additional analysis difficult. Sites followed by an asterisk were identified through the coarse filter process[9]. Most of the Sites have been identified as priorities for future inventory efforts in following sections.

- Blue Lake Marsh
- Briggsville Conifer Swamp *
- Cuff Lake
- Fox River Headwaters *
- Freedom Grasslands
- Grand Lake Wetland *
- Head of the Green Lake
- Hwy 82 Grasslands
- Jackson Kettle Complex *
- Koro Bog *
- Lime Kiln Bluff
- Lower Silver Creek
- Manchester Woods *
- Marquette Marsh *
- Meilke Lake
- New Haven Woods *
- Roy Creek Forest *
- Stone hill swamp *
- Sucker Creek
- Wood Lake

[9] See Appendix B for a description of the coarse filter analysis.

Opportunities for Conservation

The preceding section describes the relative ecological significance of a group of Sites in the FRHE study area based on our current level of knowledge. Considering the collection of Sites as a whole, there are several broad categories of "ecological opportunities" presented within the FRHE that may be useful for conservation planning. First, Table 3 categorizes the significance of all the Sites based on existing information; second, a subset of Sites are known to contain values sufficient for SNA designation; third, a number of Sites contain specific resources that are critical in themselves to warrant protection; fourth, a number of ecological restoration opportunities of regional and statewide significance exist in the study area and should be explored.

Significant Ecological Sites

Those Sites in Table 3 ranked high or medium-high appear to have greater ecological significance and may, after further review and analysis, have the highest conservation potential within the study area. Some of these Sites are currently afforded protection through state ownership; others are privately owned and assumed to be at greater risk of loss to development or habitat degradation.

Sites ranked Medium or Low also have conservation potential, but current knowledge suggests that some limitations exist: Sites lack sufficient information on ecological values, are currently degraded but may represent a restoration opportunity appropriate for state action, or contain values that may be more appropriate for local conservation efforts.

Potential State Natural Areas

The following 25 Sites contain ecological resources values that meet State Natural Areas (SNA) designation criteria and may represent ecological components that are missing or underrepresented from the existing SNAs. Designation as a State Natural Area would occur upon purchase or memorandum of understanding with willing sellers. Some of the areas below cover entire workshop sites, while others are much smaller in size compared to the workshop site. Each site is followed by the Significant Ecological Site number they fall within (see Figure 7).

- Big Spring Fens (part of #60)
- Corning-Weeting Lakes (#14)
- Dalton Wet Prairie (part of #25)
- Fairburn Wet Prairie (part of #89)
- Fluctuating Shoreline Lakes (#17)
- Fox River Crane Marsh (part of #21)
- French Creek Fens (#20)
- Klawitter Creek Fen (#36)
- Liberty Bluff (part of #13)
- Lime Kiln Bluff (#42)
- Mitchell's Glen (#55)
- Montello River Floodplain (#56)
- Mud Lake Bog (#59)
- Neenah Creek Meadow (part of #60)
- Oxford Woods and Savanna (#65)
- Packwaukee Hardwood Swamp (#66)
- Pine Knob (part of #89)
- Puckaway Flatwoods (part of #69)
- Snake Creek Wetlands (part of #89)
- Stueck's Pond (#77)
- Summerton Bog South (#81)
- Swader Tamaracks (part of #22)
- Swamp Lake (#82)
- Thompson Lakes Area (#84)
- White River Pines (part of #88)

Species/Natural Communities of Significance

The FRHE study area is important for many rare plants, animals, and natural communities. Plant species for which the FRHE is particularly important include the State Endangered brook grass (*Catabrosa aquatica*), soft-leaf muhly (*Muhlenbergia richardsonis*), and dwarf umbrella sedge (*Fuirena pumila*), as well as the State Threatened long-beaked bald rush (*Psilocarya scirpoides*) and Special Concern species bushy aster (*Aster dumosus* var. *strictior*). Animal species include the swamp metalmark (*Calephelis muticum*) and powesheik skipperling (*Oarisma powesheik*), both State Endangered and globally rare butterflies. The FRHE also contains a State Threatened dragonfly, the spatterdock darner (*Aeshna mutata),* as well as the State Endangered western slender glass lizard (*Ophisaurus attenuatus*). The FRHE is important for several species of grassland birds such as the State Threatened Henslow's sparrow. Significant populations of Special Concern animals include the Wisconsin endemic tiger beetle (*Cicindela patruela huberi*). The FRHE is an important area for the Federally Endangered Karner blue butterfly (*Lycaeides melissa samuelis*) and contains a number of occurrences of the federal candidate Eastern Massasauga rattlesnake (*Sistrurus catenatus catenatus*).

The **Coastal Plain Marsh** natural community consists of sandy to peaty-mucky lakeshores, pond shores, depressions, and ditches in and around the bed of former glacial Lake Wisconsin. These communities harbor assemblages of wetland species and there is often a well-developed concentric zonation of vegetation with a varying composition and width depending on fluctuations in water levels. Frequent members of this community are sedges in the genera *Cyperus, Eleocharis*, *Fimbristylis*, *Hemicarpha*, *Rhynchospora* and *Scirpus*, rushes (*Juncus* spp.), milkwort (*Polygala* spp.), toothcup (*Rotala ramosior*), grass-leaved goldenrod (*Euthamia graminifolia*), hardhack (*Spiraea tomentosa*), lance-leaved violet (*Viola lanceolata*), and yellow-eyed grass (*Xyris torta*).

In addition, the Coastal Plain Marsh contains a number of **Coastal plain disjunct** species – species more commonly found along the Atlantic Coast and thus considered "disjunct" or separate from their home range. The FRHE provides one of the finest areas in the state for Atlantic Coastal Plain disjuncts, including Virginia meadow beauty (*Rhexia virginica*), long-beaked bald rush (*Psilocarpa scirpoides*), dwarf umbrella sedge (*Fuirena pumila*), hidden-fruited bladderwort (*Utricularia geminiscapa*), and crossleaf milkwort (*Polygala cruciata*).

Three of the six documented occurrences of the Coastal Plain Marsh community in Wisconsin are found within the FRHE. Additional inventory efforts could provide a better understanding of the status, condition, and content of these communities. Sites that provide opportunities for conservation of the Coastal Plain Marsh community and Coastal Plain disjuncts include:

- Stueck's Pond
- Silver and Mud Lakes

The FRHE contains nearly one-third of the documented occurrences of the **Calcareous Fen** natural community type in Wisconsin. Calcareous fens are found in southern Wisconsin and are an open wetland type often underlain by a calcareous substrate through which carbonate-rich groundwater percolates. The flora of these fens is typically diverse, and several rare plant species have been documented in these communities within the FRHE, including the State Threatened sticky false-asphodel (*Tofieldia glutinosa*) and the State Endangered soft-leaf muhly (*Muhlenbergia richardsonis*), as well as the Special Concern species common bog arrow-grass (*Triglochin maritima*), slender bog arrow-grass (*Triglochin palustris*), whip nutrush (*Scleria triglomerata*), and low nutrush (*Scleria verticillata*). Also present is a significant population of the State Endangered swamp metalmark butterfly (*Calephelis mutica*).

The FRHE contains examples of the fire-adapted **Oak Barrens** natural community type known to contain State Endangered animal species such as the western slender glass lizard (*Ophisaurus attenuatus*) and Special concern animal species such as the tiger beetle (*Cicindela patruela huberi*). Rare plants found in these communities include the State Threatened species wooly milkweed (*Asclepias lanuginosa*) and brittle prickly pear (*Opuntia fragilis*), as well as the State Special Concern species prairie fame-flower (*Talinum rugospermum*). Examples of Sites that provide opportunities for conservation of this community include:

- Oxford Woods and Savanna
- Lime Kiln Bluff

Restoration Opportunities

The FRHE study area encompasses a unique landscape that offers many opportunities for habitat and ecosystem restoration. Several restoration efforts, primarily for grasslands (WDNR 2001), have been initiated recently within the FRHE study area. Although detailed analysis has not been completed to evaluate the restoration priorities for any given habitat, there is sufficient knowledge to identify a number of Sites with excellent restoration potential.

The Sites listed below represent the best restoration opportunities based on existing knowledge. In some cases, the Sites currently include partially degraded habitat and most are placed in the medium ecological significance category in Table 3. Better examples of the following community types exist within the study area and are highlighted in Table 3.

Dry Forest-Oak Savanna-Dry Prairie Continuum
Presettlement data describes the uplands of the FRHE as having natural community patterns running the entire vegetation spectrum from dry forest to open prairie. Many of these natural systems have been converted to farming or conifer plantations within the FRHE, significantly impacting numerous species. Most of the communities along this natural continuum are fire-dependent, and fire will likely be a necessary management tool for restoring or maintaining them. Additional information is needed to further our understanding of the current quality and extent of existing remnants, highlighting the need for additional inventory work in the future. Sites that provide opportunities to restore the entire Dry Forest-Oak Savanna-Dry Prairie Continuum to the FRHE should be a priority. Potential restoration sites for the dry forest-oak savanna-dry prairie continuum include:

- Oxford Woods and Savanna
- Head of Green Lake (nearby uplands)
- Page Creek Oak Barrens
- Lawrence Creek
- Limekiln Bluff
- Greenwood Wildlife Area
- Jackson Kettle Complex

Wetlands
Wetlands in the FRHE are highly variable and include communities with more northerly affinities, such as Northern Sedge Meadows, as well as those associated with southern Wisconsin like Calcareous Fens, Tamarack (rich) Swamps, Southern Sedge Meadows, and Wet and Wet-mesic Prairies. The FRHE also contains communities that are more widespread across the state such as Alder Thickets and Emergent and Submergent Aquatic communities. Drainage for agriculture and development, grazing, and the spread of

invasives such as reed canary grass have altered many, if not most, of the wetlands within the FRHE. Sites with potential for wetland restoration include:

- Page Creek (Also a TNC restoration priority)
- Grand River Wildlife Area
- Puchyan Prairie[10]
- White River Marsh
- Comstock Bog - Meadow[11]
- Summerton Bog North / South

Lakes

The FRHE has an excellent diversity of lake types including both deep and shallow, clear, hardwater, sandy bottomed lakes, fluctuating shoreline lakes, bog lakes, spring ponds, oxbow lakes, and flowages. At least one lake (Stueck's Pond) has unique properties and supports the only known intact population of the State Threatened dragonfly spatterdock darner (*Aeshna mutata*). The deep, clear, hardwater lakes are the most developed, but some good intact examples remain. Sites with potential for lake restoration include:.

- Bass Lake
- Jackson Kettle Complex

Rivers & Streams

The FRHE has a significant number of intact cold hard headwater streams, many of which are included in State Fishery Areas. Much less common are the larger warmwater streams. The Fox River itself supports aquatic life, but is probably too degraded to support several species which are found in the lower White River. The segment of the White River from the dam in Neshkoro to the Fox River is probably the best warmwater stream in the FRHE. However, the dam at Neshkoro is a possible source of concern for the integrity of the White River system because the river may be subject to extreme fluctuations in flow. The Mecan River is renowned for its water quality and contains a rich invertebrate fauna. Sites with potential for river and stream restoration include:

- Lawrence Creek
- Lunch Creek
- French Creek
- Silver Creek
- White River – West Branch
- Montello River (floodplain forest)

Invasive Species Management

Invasive species, whether native or exotic, are an increasing threat to natural habitats within many parts of the FRHE. Invasive species, such as purple loosestrife, garlic mustard, exotic honeysuckles, and rusty crayfish can become established in natural communities and displace desirable native species, thereby degrading the habitat that other species depend upon. Land managers and concerned private landowners in the FRHE should be aware of the threats that invasive species pose. A key to challenging the spread of invasive species is first to identify populations and then work to reduce or eliminate those occurrences.

[10] This site is part of the larger White River Marsh site and is one of the largest wet grasslands in the state (R. Hoffman, personal communication). A portion of this wetland is currently a State Natural Area.
[11] This site is part of the larger Germania Wildlife Area site.

FRHE planners and conservation organizations could help prevent or control invasive species outbreaks by establishing "buffer areas" around high quality sites to minimize the effects of surrounding disturbances that often lead to invasions. Also, management needed to help maintain a site should be timed and impacts that spread invasives avoided in order to minimize the possibility of introducing invasives to ecologically important sites.

Issues Affecting the FRHE

For all of its important ecological resources in the study area, the FRHE has been, and continues to be, impacted by many of the same environmental issues that affect other parts of the state. Many of these issues are related to incompatible land uses. The Bureau of Endangered resources has not conducted a thorough examination of all of the environmental issues affecting the FRHE. However, there are several key items affecting natural habitats within the FRHE, based on information provided by the workshop contributors and current BER knowledge of the area; these are listed below. Most of these issues have been covered in detail in other reports and publications[12]. See Appendix E for site-specific threats as submitted by Workshop contributors.

1. **Impacts to Water resources**
   - Dams
   - Altered hydrological regimes (e.g., ditching)
   - Nonpoint source pollution (e.g., eutrophication, sedimentation)
   - Shoreline development
2. **Invasive species (aquatic and terrestrial plants and animals)**
3. **Fire suppression**
4. **Recreational impacts**
5. **Ecosystem Simplification** (e.g., pine plantation or crop monocultures replacing native communities)
6. **Ecosystem Fragmentation** (e.g., such as caused by development, increase in multiple ownerships within a given area, residential and commercial development, and agriculture)

[12] see "Additional Resources"section

Future Information Needs

A comprehensive evaluation of the broad biodiversity and endangered species concerns within the FRHE study area is currently limited by a lack of knowledge and information regarding many of the Sites. Additional inventory on specific Sites and status surveys for individual species and natural community types is critical to broaden our understanding of the ecological significance of the study area.

The Sites listed in this section are priorities for future biotic inventory efforts within the FRHE study area based on information submitted for the workshop, current NHI data, and subsequent interpretation. These inventory priorities represent gaps in our current level of information in the following categories:

Need for Boundary Revisions

The boundaries of most Sites were compiled by aggregating all the workshop sites that overlapped or were within close proximity in a particular area. The expertise and accuracy applied to boundary delineation was different for each contributor. Sites were not subsequently reviewed in detail sufficient to delineate an appropriate boundary that reflects the resources of significance. Thus, boundaries may expand or decrease depending upon further analysis. This work should be completed prior to any site protection.

Significant Ecological Sites

Many of the Significant Ecological Sites lack adequate information regarding their value for biodiversity and endangered resources. Inventory at the following Sites may significantly change each Site's prioritization and improve our understanding of the Site's potential to harbor rare plants, animals, or natural communities.

Table 4. Priority Sites for Future Inventory

Site Name	Ecological Significance Category
Mud Lake	High
Silver and Mud Lakes	High
Corning - Weeting Lakes	Medium-High
Fluctuating Shoreline Lakes	Medium-High
Klawitter Creek Fen	Medium-High
Montello River	Medium-High
Sugar Island Wetlands	Medium-High
Summerton Bog North/South	Medium-High
Bass Lake	Medium-High
Page Creek	Medium-High
Adams Cty. Waterfowl PA	Medium
Bog Relics	Medium
East Jordan Woods	Medium
Grotzke Rd. Area	Medium
Harris Marsh	Medium
Head of Green Lake	Medium
Jackson Kettle Complex	Medium

Site Name	Ecological Significance Category
Lewiston Flatwoods	Medium
Lime Kiln Bluff	Medium
Lower Silver Creek	Medium
Lucerne Lake	Medium
Meilke Lake	Medium
Moon-Echo Lakes Area	Medium
New Haven Woods	Medium
Oxford Woods and Savanna	Medium
Packwaukee Hdwd. Swamp	Medium
Rock Hill Outcrops	Medium
Soules Creek Area	Medium
Sucker Creek	Medium
Swan Lake Wildlife Area	Medium
Thompson Lakes Area	Medium
White River - West Branch	Medium
Koro Bog	Low
Little Green Lake Mesic Forest	Low

Status Survey Needs for Species and Natural Communities

A better knowledge of the distribution and abundance of certain plant and animal species and natural communities within the FRHE would add to our understanding of the area's significance. Status surveys within the FRHE for the following communities and species are recommended (this list is not exhaustive):

Birds
- forest raptors
- grassland birds
- migratory shorebirds

Fish
- pugnose shiner

Insects
- aquatic invertebrates
- grassland invertebrates
- wetland lepidoptera

Mammals
- Small mammals

Natural Communities
- Coastal Plain Marsh
- Northern Sedge Meadow
- Pine Barrens
- Oak Barrens

Plants
- squarestem spikerush
- brook grass

Reptiles
- Blandings turtle
- massasauga rattlesnake
- slender glass lizard

Rare Species Occurrences Not Included Within Significant Ecological Sites

Some areas within the FRHE contain documented occurrences of rare species that are not captured within one of the Significant Ecological Site boundaries. Many of these records are outdated or the areas lack adequate inventory. Further evaluation is necessary to better understand their significance, particularly at the following locations:

- Dakota Swale: Bushy aster (*Aster dumosus* var *strictior*) was recorded here
- Portage Marsh: Historic site for the Massasauga rattlesnake (*Sistrurus catenatus catenatus)*
- Crooked Lake: historic site for squarestem spike rush (*Eleocharis quadrangulata*) and 3 natural communities
- Fairburn Wet Prairie: Wet-mesic Prairie immediately northeast of the White River Marsh Wildlife Area
- Armchair Lake: one of few northern sedge meadows in this area and part of the study area with little detailed information but several natural communities

Additional Resources

The general ecological issues that affect the FRHE are addressed in several publications and other materials available from the WDNR and other organizations. In addition, background information on species, natural communities and restoration strategies are available to assist with conservation planning and management planning. These resources are listed below. The BER web site (http://www.dnr.state.wi.us/org/land/er/) will soon contain updated lists of these and other resources, as well as other website links where available.

Ecological Issues and Conservation Planning within the FRHE

- Wisconsin's Biodiversity as a Management Issue Report, Wisconsin Department of Natural Resources, May 1995, http://www.dnr.state.wi.us/org/es/science/pubs/tr/biodiversity_manage_book.htm
- Wisconsin Manual for Control of Invasive Exotic Plant Species, 1997, http://www.dnr.state.wi.us/org/land/er/invasive/
- America's Least Wanted: Alien Species Invasions of U.S. Ecosystems (Stein and Flack 1996), The Nature Conservancy and NatureServe, http://www.natureserve.org/publications/leastwanted/index.htm
- The Prairie-Forest Border Ecoregion: A Conservation Plan (TNC 2001), The Nature Conservancy
- Managing Habitat for Grassland Birds: A Guide for Wisconsin (Sample and Mossman 1997)
- Wisconsin's Forestry Best Management Practices Monitoring, 1995-97, Div. of Forestry
- A Regional Natural Areas and Critical Species Habitat and Protection Management Plan for Southeastern Wisconsin, No. 42, 1997
- Wisconsin DNR Biodiversity Report, 1995

Endangered Resources within the FRHE

Resources available from BER by calling (608) 266-7012 or emailing ber@dnr.state.wi.us

- List of Wisconsin's Endangered and Threatened Species (also available through the BER Web site)
- Natural Heritage Inventory Natural Communities—2001 version (also available through the BER Web site)
- Standard references for taxonomic groups and communities
- Summary of SNA information and sources
- Wisconsin Butterflies Checklist
- List of Barrens and Dry Prairie Associated Moths
- Dragonflies of Wisconsin Checklist
- List of other BER publications and other materials available – including those listed below
- The Endangered and Threatened Invertebrates of Wisconsin, 1999, PUB-ER-085-99
- The Endangered and Threatened Vertebrates of Wisconsin, 1997, PUB-ER-091
- Guide to Wisconsin's Endangered and Threatened Plants, 1993, PUB-ER-067
- Threatened and Endangered Species in the Forests of Wisconsin: A Guide to Assist with Forestry Activities, 2000
- Database of Rare Plant Species by Habitat Type
- Bald Eagles in Wisconsin: A Management Guide for Landowners, 1997
- Peregrine Falcons: A Native Returns to Wisconsin Activity Guide

- Wisconsin's Endangered Flora
- Wisconsin Wolf Management Plan, 1999
- Amphibians of Wisconsin, 2001
- Snakes of Wisconsin, 2000

The materials below are technical bulletins available from the Bureau of Integrated Science Services Research Center or the Division of Forestry:

- Plant Species Composition of Wisconsin Prairies, Tech. Bull. No.188, 1995
- Atlas of the Wisconsin Prairie and Savanna Flora, Tech. Bull. No.191, 2000
- Checklist of the Vascular Plants of Wisconsin, Tech. Bull. No.192, 2001

Web Sites Links with Additional Information

- List of internet links from ER Website, http://www.dnr.state.wi.us/org/land/er/links.htm
- NatureServe Website, http://www.natureserve.org/
- NHI Online Database, http://www.dnr.state.wi.us/org/land/er/nhi/NHI_ims/onlinedb.htm
- Breeding Bird Atlas Maps for Listed Species, http://www.uwgb.edu/birds/wbba/
- Wisconsin Herpetological Atlas website, http://www.mpm.edu/collect/vertzo/herp/atlas/atlas.html
- The Wisconsin Vascular Plant Web Page, Wisconsin State Herbarium, UW-Madison, http://www.botany.wisc.edu/wisflora/
- USGS Northern Prairie Wildlife Research Center Web Site: www.npwrc.usgs.gov
- Online version: *Wetland Plants and Plant Communities of Minnesota and Wisconsin*, by Steve Eggers and Donald Reed: www.npwrc.usgs.gov/resource/1998/mnplant/mnplant.htm
- Karner blue butterfly information: www.dnr.state.wi.us/org/land/er/publications/karner/karner.htm
- Fish and Wildlife Service information on federal species: http://midwest.fws.gov/endangered/saving/outreach.html
- Michigan Natural Features Inventory Abstracts: http://www.msue.msu.edu/mnfi/abstracts.htm
- Missouri Natural History Division Abstracts: http://www.conservation.state.mo.us/nathis/endangered/bmp.htm
- Field Guides Online, http://www.enature.com/
- USDA Natural Resources Conservation Service Plants Database, http://plants.usda.gov/
- USDA Fire Effects Information System, http://www.fs.fed.us/database/feis/

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